Northumbria University
NEWCASTLE

Engineering and Environment PGR Conference 2018

RESEARCH FOR A BETTER TOMORROW

Communicating with and Engaging Non Expert Audiences

21st June 2018   9.00 – 16.30   Ellison Building

Foreword

Postgraduate research students in the Faculty of Engineering and Environment work across an extraordinary range of interests and disciplines. Last year's conference foregrounded the shared requirement to communicate with and engage non-expert audiences. Whether working in cross-disciplinary teams, exchanging knowledge with external collaborators, or disseminating findings and applying these in the public realm, it remains essential that the language and concepts of our disciplinary area are communicable and understandable by those beyond our own area of expertise. This year's student organising committee members were keen to retain this focus and have, at the same time, challenged contributors to explain to those audiences how their work will contribute to a 'better tomorrow'.

The Engineering and Environment PGR conference aims to provide a safe and constructive environment in which to test ideas and hone presentation skills. This year we have also added a range of development workshops tailored to the needs of PGR students. Our intention is to support cross-disciplinary exchange and reflection. With students from all five departments represented across the presentations, posters and workshops, the parallel sessions have been organised around cross-cutting stages common to most doctoral processes and theses: Literature Review/Wider Concepts; Research Methodologies; Expectations/Reflections; and Discussions/Conclusions.

Take note of the student contributions that you find most successful and engaging - you will be asked to vote for the best presentation/workshop by the end of the day. There will be a prize for this and for the best poster - as chosen by our keynote speaker - each to be presented at the final session. I take this opportunity to thank the RIS research support team, the students on the organising committee and the PGR Programme Leaders for their time and care in providing organisational support. Thanks too go to our keynote speaker for offering her time so generously and to those members of staff facilitating workshops. I hope that you enjoy the day that we have collectively concocted.

Rosie Parnell (E&E PGR Director)
June 2018
Northumbria University

PGR Student Conference Committee 2018:

Adejimi Adebayo, Orsolya Bokor, Dmitry Dereshev (coordinator), Diogo Henriques, Seyedmehdi Hosseini Biroun, Muhammad Khalid, Sreepathy Sridhar, Agnieszka Wir-Konas, Demet Yesiltepe, Eman Zied Abozied.

Keynote Speaker

Dr Marjan van de Weg

Marjan van de Weg started her career as an ecologist, studying carbon uptake of high-altitude rainforests during her PhD (University of Edinburgh, 2011), followed by post-docs in the US and the Netherlands. When the lectureship she had just obtained was made redundant in 2015 due to budget cuts, she decided to leave academia for a different career. A process that was not straightforward and challenging at times! After a detour in free-lance scientific editing and consultancy, she currently works for an environmental NGO in Edinburgh. In addition, Marjan shares the lessons she learned in her transition with current PhD students and post-docs through workshops and coaching. After all, exploring job opportunities outside academia can be difficult during your PhD, or not even on your mind, but it pays off to consider your options and to prepare for them in time.

Keynote Address:
Navigating the non-academic job market without getting lost
In her talk, Marjan will discuss how to explore the non-academic job market and what non-academic employers are looking for (Hint: it's unlikely to be your thesis topic!) She is offering a workshop later in the day, which will address how to identify your skills and plan your job search strategically.

Abstracts

Architecture & Built Environment

Driving Improvements in Productivity and Performance Through Engagement Between Higher Education (HE) and Industry
| **Workshop** | Literature Review and Wider Concepts
By **Susan Dawson** (susan.dawson@northumbria.ac.uk)

Abstract: The Architecture, Engineering and Construction (AEC) sectors are major contributors to the world's economy. For example, in the UK alone their contribution exceeds £110 billion per annum. However, despite its significance, AEC has been continually criticised for high levels of fragmentation, poor productivity and efficiency, and a general lack of innovation. This is in stark contrast to (seemingly) better performing sectors such as aerospace, information technology and oil and gas. Consequently, such a perception has manifested itself with an impact on skills, levels of research and innovation and more importantly, the attraction and retention of human 'talent' – more specifically, 'intellectual capital'. Cognisant of these challenges, the aim of this workshop is to harvest opinion and discussion, through the research lens of the Higher Education (HE) sector.

This discussion seeks to identify:

- Exemplars of engagement between HE and higher performing industries;
- Key enablers and blockers of partnerships of this type;
- Associated benefits and risks to their stakeholders.

An expected outcome of the workshop is to establish the underpinning rubrics needed for a translational engagement model to meet AEC/ Higher Education Institutions' (HEI) needs. From an empirical perspective this workshop enables the collection of data from a non-probability sample of academics who have experience of engagement activities of this type. It forms part of wider research exploring how strategically embedded innovation within AEC processes can be purposefully leveraged to nurture sector improvements.

Maps as Real Estate Tool: How Data Classification Deceives
| **Presentation** | Research Methodology
By **Adebayo Adejimi** (adejimi.a.adebayo@northumbria.ac.uk)

Abstract: Maps are spatial outputs of analysed data inputs. There has been increasing usage of maps generated from GIS tools among real estate market actors all over the world. This is because maps enhance visualization of property market variables while revealing its locational performance. As such, key decisions are made by real estate actors (and other map users) based on its products without validation of precision. Even when such precision is evaluated, the mode of data input classification is not considered as part of the map validation procedure.

This study exposes the importance of data input classification in validating maps utilized by real estate actors. It presents how spatial outputs vary with consistence data inputs within GIS tools. The study utilizes QGIS software tools in conducting this investigation, while using rental value (obtained from the Valuation Office Agency VOA dataset) as the data input variable. The study examines all the five pre-defined modes of data classification, namely - equal quartile, equal interval, natural breaks, standard deviation and pretty breaks. The study reveals that maps (spatial outputs) changes as mode of classification changes. It concludes that the mode of classifying data input influences the map. The study therefore recommends that maps generated through data inputs (variables) using GIS and other cartographic elements should not ignore the impact of mode classification, and when necessary communicate such changes to the final map users.

The Use of Simulation Approaches to Effectively Model Construction Processes
| **Presentation** | Literature Review and Wider Concepts
By **Orsolya Bokor** (orsolya.bokor@northumbria.ac.uk)

Abstract: Simulations are widely used to model real-life systems because they can handle complex systems of any size. The simulation model attempts to represent reality to an extent determined by the purpose of the study. It will inherently contain the uncertainties associated with the system. This can be especially useful in the case of construction projects, which are characterised by a high degree of uncertainty that stems from their unique nature. Thus, simulations can be used effectively to better understand the workings of a given system. Furthermore, they can be applied to safely test how various interventions would affect the system; thus, helping any decision-making process. In the construction field, three basic simulation approaches tend to be applied: discrete-event simulation (DES), system dynamics (SD), and agent-based modelling (ABM). These approaches can be used alone or in combination with each other or with other methods, such as neural networks (NN) or fuzzy logic (FL). The presentation introduces the basic approaches, their characteristics, advantages, disadvantages, and possible applications within the construction field and beyond.

The Concept of the City Centre
| **Presentation** | Literature Review and Wider Concepts
By **Sepideh Hajisoltani** (sepideh.hajisoltani@northumbria.ac.uk)

Abstract: 21st century cities operate in new patterns that are radically different from urban models of the 20th century. In the broad context of urban studies, there is a growing focus on future cities and assertion of what new technologies can offer. At the cusp of this change, there is an increasing interest in the study of city centres where these transitions are being played out. The complex interconnections of current environmental, social, political and economic transitions could be at the core of the future of UK city centres. The perceived ability of city centre to traverse disciplinary edges makes it an important subject for many established disciplines and creates the possibility for cross-disciplinary and inter-disciplinary research. This presentation aims to provide a better understanding of the concept of the city centre and focuses on environmental, social, political and economic perspectives to discover what distinguishes the city centre from other urban areas. An improved understanding of the concept of city centre is critical in the context of developing scenarios for the future of city centres.

Playground Anxieties: An Account of Practicing Ethnography in The Playground Heterotopia
| **Presentation** | Research Methodology
By **Alkistis Pitsikali** (alkistis.pitsikali@northumbria.ac.uk)

Abstract: Driven by fears both of and for children, the public playground provides clear-cut distinctions between childhood and adulthood. Drawing on an ethnographic study carried out in three sites in Athens, Greece, this study examines the playground space as a heterotopia of deviance, exploring how fear manifests itself in the playground. Emergent themes show fear to underpin control and surveillance (by both adults and children) and the porosity of the playground's boundaries, as regulated by parents and societal norms. These fears were present during the whole course of the fieldwork for this research, constantly affecting my methods. The data collection, placed in urban public spaces, was a challenging one. There questions to be asked about it: what is the relation between the academic methodology chapter and the real fieldwork experience? How much is too much when structuring ethnographic research? In this presentation I am going to explore the reciprocal relation between methods and the fieldwork. Reflecting on my own practices, positionality and emotions, I will stress the challenges encountered in the field as well as the ways I dealt with them. Being conscious of the position of the researcher as an adult in a child-centred place, I will explore the ways my methodology developed after each fieldtrip while stressing the importance of the pilot study. Moreover, I will outline the reasons that led to an ethics amendment to be able to engage participants with my research, and the importance of flexibility when conducting the fieldwork.

A Biomimetic Future: How Can Nature Inspire Us to Re-Imagine the Future of The Construction Industry?
| **Presentation** | Expectations and Reflections on Research
By **Ehab Sayed** (ehab.sayed@northumbria.ac.uk)

Abstract: Rapid population growth in cities across the globe is resulting in an equally fast-growing built environment. Unfortunately, conventional construction systems and materials, which currently dominate global building practices are highly damaging to the environment and inhabitants' health. The Architecture, Engineering and Construction (AEC) industry has failed to adequately respond to climate change and global energy insecurities in time, consuming over half of the earth's natural resources and contributing around 50% of the global environmental impact. Governments, however, are starting to support a transition in the industry towards healthier and more sustainable building methods and materials, such as off-site manufacturing (OSM) and the use of bio-based materials. Systems in nature which have been developed and optimised over billions of years may help us identify new approaches to building and manufacturing. Biomimetics or the abstraction of formations, structures, functions and processes in biological systems to synthesise man-made products and systems that solve a problem is a field which is growing in popularity in architecture. Combined with the growing circular economy, which maximises product and material value and champions' end-of-life considerations, biomimetic approaches can transform the industry to adequately and more efficiently meet our Environmental, Social and Economic (ESE) needs.

An Explanation of The Relationship Between Spatial Layout and Spatial Navigation Choices in Virtual Environments
| **Presentation** | Research Methodology
By **Demet Yesiltepe** (demet.yesiltepe@northumbria.ac.uk)

Abstract: The aim of this presentation is to explain the effect of different spatial layouts and conditions on navigation choices. A mobile- based virtual game, Sea Hero Quest, which has been played by more than 4 million people, was used to examine the aim. In wayfinding levels of the game, participants first see a map, which includes the specific destinations that they should reach. Then the map disappears, and participants are asked to navigate a boat and to find these destinations.

Time and distance performance of participants were recorded and the spatial environments they travelled were analysed by using various syntactic measures, including axial and segmentally-based integration and choice values; and visible graph analysis. In addition, levels that include different weather (foggy/clear) and map (normal/obscured) conditions were added to the analysis to compare the effect of these factors.

It is expected that the results of this study will provide new insights for urban planners and designers into designing urban environments.

Framing the World Hopefully: Contemporary Applications of the Picturesque in Architecture
| **Presentation** | Discussion and Conclusions
By **Shaun Young** (shaun2.young@northumbria.ac.uk)

Abstract: In the eighteenth century, the Picturesque fundamentally altered our way of seeing the world. It emerged from a moment of instability in our aesthetic understanding and allowed us, for the first time, to derive creative inspiration from the physical landscapes around us. It was a new mode of vision that privileged the overlooked, and elevated to the level of art, landscapes and objects previously deemed unworthy of artistic attention. Despite its significance, the Picturesque remains a seldom-visited landmark in western culture and there is little understanding of how some of its concepts and techniques continue to influence our creative practices.

For architecture, the Picturesque represented a radical reconfiguration of relations between building, landscape, and painting. It was a moment where representation and reality entered a reciprocally conditional dialogue and allowed us to move between the idealised landscapes of the mind and the physical reality of the landscape as-found. This propositional way of seeing meant that buildings were conceived in relation to the particularities of their landscape settings, with certain qualities of the landscape reflected in the architecture.

This inquiry argues that within the Picturesque tradition lie a set of ideas that are resonant in contemporary architecture and can offer us a hopeful lens through which we can re-evaluate the relationship between buildings and contemporary landscape conditions. Using a practice-led approach, Picturesque concepts and techniques at work in contemporary practice, are identified and explicated with potential new applications explored in real time through a series of design projects.

Creating Community in the City of the Dead
| **Presentation** | Discussion and Conclusions
By **Eman Zied** (eman.abozied@northumbria.ac.uk)

Abstract: This study focuses on how community is created in the informal settlement of Cairo's "City of The Dead", a large cemetery in historic Cairo; and how the spatial structure can support the creation and maintenance of a sense of community in the urban fabric that was not designed to accommodate a community's everyday living. People dwelling there maintain strong social bonds and have a strong sense of community, despite living in an urban area that, on the surface, does not accommodate public spaces, community areas and space for everyday living.

The methods for this study are based on Lefebvre's idea of "social space" which introduced urban space as a tool of investigation for society. This is supported by Hillier and Vaughan, who suggest that the spatial structure of the city directly reflects its social structure, and vice versa. The study combines space syntax analysis and urban morphology studies with qualitative methods to create a holistic view of both the physical spatial relationships; and the sense of community in the "City of the Dead". Space syntax analysis, urban morphology studies, direct observations and interviews will be used as methodology. These analyses will indicate whether the spatial structure and morphological attributes of the settlement supports the maintenance of a sense of community, or if the residents must find alternative approaches to sustaining their everyday lives and creating their own public space.

Towards Identifying the Contemporary Dwelling Model: Exploring the Influence of the Socio-cultural Changes on the Design of High-Density Residential Environments in England
| **Poster** | Expectations and Reflections on Research
By **Heba Sarhan** (heba.sarhan@northumbria.ac.uk)

Abstract: The quality of space in residential environments in England represents a problematic issue in the implementation of the new residential developments. However, there has been a limited number of studies exploring the spatial characteristics of the contemporary dwelling model in respect to socio-cultural changes in family home-life. This research aims to provide an understanding of the spatial characteristics of the contemporary dwelling model in high-density contexts. It will explore the influence of socio-cultural changes in the meaning and the use of the dwelling place. Drawing upon the assumption that a dwelling place and the use of space are manifestations of culture, the research explores the spatial structure that emerges because of residents-place transactions during their experience of home-life. Taking a qualitative approach, multiple data collection methods will be employed throughout the stages of the fieldwork. The research employs three case studies that represent different examples of the implication of the socio-cultural dimensions on the form of the residential spaces in high-density residential contexts. The contemporary dwelling model will be constructed by comparing the congruency of the structure of the lived space with the pre-existing physical space in each case, to identify: first, commonalities and variables in the investigated dwelling model; and second, the socio-cultural dimensions which need to be addressed for designing residential environments in response to residents' needs.
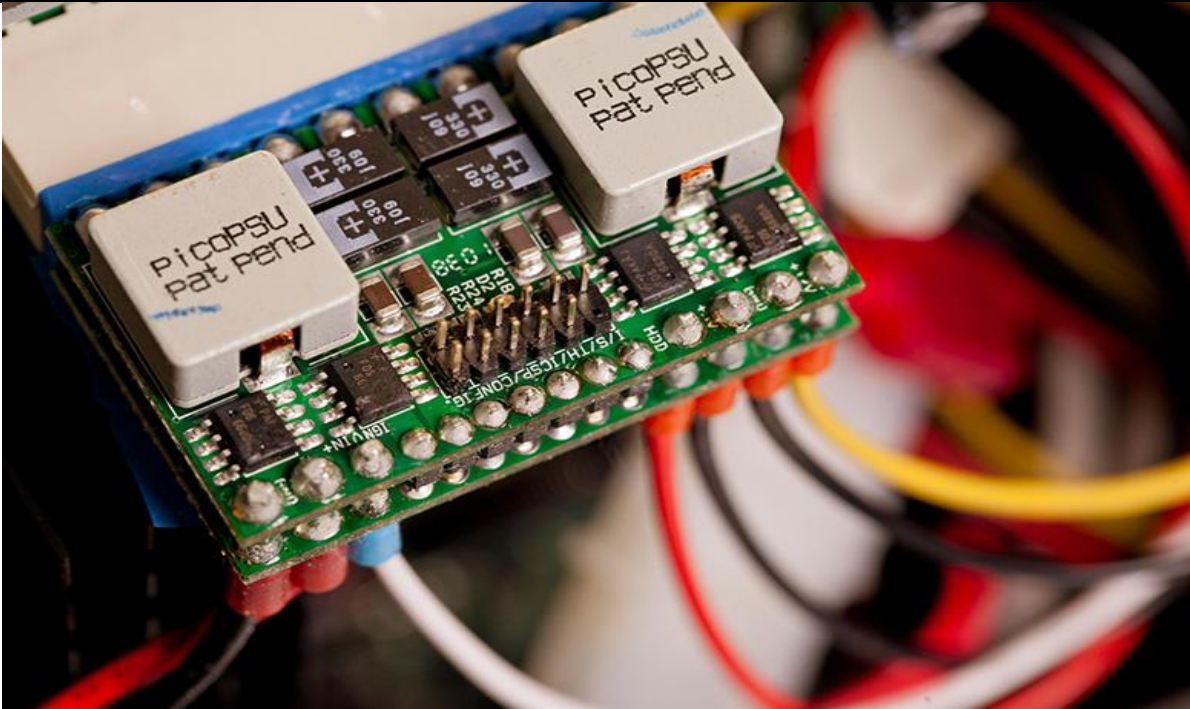
Computing & Information Sciences

Exploring Sustainability Through Speculative Futures
| **Workshop** | Research Methodology
By **Simran Chopra** (simran.chopra@northumbria.ac.uk)

Abstract: Current food production and consumption patterns are unsustainable. They are an outcome of the influence of politics, economics and sociocultural constructs. Food is an everyday mundane that we need to decide on three or four times in a day. This decision rather than building on an informed choice is built on the complexity of demand and supply, governed by the principles of industrial revolution. We propose a semi structured workshop taking a participatory and speculative design approach, grounded in life experiences and local material re-imaginings, to negotiate past, present, and future practices of food production and consumption (Baumann et al 2017; Forlano 2016; Light et al 2009). The method engages student communities in the co-design of sustainable food futures, creative exploration and critique of present practices.

The future of eating in the 21st century has been imagined before in popular culture e.g. foraging for food (Dunne et. al. 2014), pills and food popping up in machines whenever one wishes[1]. Also, with the food computer at MIT [2], it is already possible to manifest desired qualities or tastes in the vegetables through the control of moisture and nutrients. The design task that we take up is to design a future that do not rely on present technological possibilities open possibilities for design, sustainability and society. Our aim is to question the trajectories of food through design fiction to understand current food practices better and to broaden our thinking on sustainable food futures.

References

[1] Karl Baumann, Benjamin Stokes, François Bar, and Ben Caldwell. 2017. Infrastructures of the Imagination: Community Design for Speculative Urban Technologies. (2017), 15–18. DOI: https://doi.org/10.1145/3083671.3083700

[2] Laura Forlano. 2016. Decentering the Human in the Design of Collaborative Cities. 32, 3 (2016). DOI: https://doi.org/10.1162/DESI

[3] Ann Light, Lois Weaver, Gini Simpson, and Patrick G T Healey. 2009. Geezers, turbines, fantasy personas: making the everyday into the future. (2009), 39–48. DOI: https://doi.org/10.1145/1640233.1640243

[4] Dunne A., Raby F., 2014. Speculative Everything: Design, Fiction and Social Dreaming. MIT Press, Cambridge, MA.

Notes

1. http://www.startrek.com/database_article/replicator

2. https://www.media.mit.ed u/research/groups/person al-food-computer

A New Interaction Method in Visualization: Brushing in Parameter Space
| **Presentation** | Research Methodology
By **Halil Agin** (halil.agin@northumbria.ac.uk)

Abstract: With the deluge of big data, scientists encounter data that is heterogeneous, complex and large in different aspects; i.e. velocity, variety, volume, and veracity. Converting data into information and gaining knowledge from it has become the main concern in information visualisation. Research in this area mainly focuses on representing the information of data samples and less often on parameter space visualisation. In this paper, we propose a visualisation approach that allows analysts to carry out exploratory analysis in parameter space and observe the results in the sample space using parallel coordinates. Having intrinsic knowledge about the patterns in the latent semantics of the data sample by brushing in parameter space, the analyst can identify interactions or relations among the dimensions of the multivariate data set. The research presented can be considered an extension of earlier research in visual parameter space analysis, the dual visual analysis model, and brushing techniques adapted to parallel coordinates.

A Comparative Study of Native and Non-Native Information Seeking Behaviours
| **Presentation** | Discussion and Conclusions
By **David Brazier** (d.brazier@northumbria.ac.uk)

Abstract: The proliferation of web-based technologies has led most national governments to begin transitioning to a so called \e-service," where provision is made through purely digital means. Despite their obvious benefits for most users, these on-line systems present barriers of access to certain groups in society. In this study, we consider the information behaviour of English as a second language (ESL) and native English-speaking participants as they conduct search tasks designed to reflect actual information seeking situations in a UK governmental context. Results show that the ESL users rely more on query assistance, delve deeper into the Search Engine Results Page (SERP) and obtain better performance the longer they read documents. This was not the case for the natives, despite spending the most time reading documents. There are some similarities in their information seeking behaviours as both groups submit similar length queries and are equally proficient in identifying when a failed query did not meet their information need. This proficiency was not reflected in their performance in some tasks, with both groups unable to consistently predict when they had not performed well. The results of this work have potentially profound repercussions for how e-government services are provided and how users are assisted in their use of these.

Current Developments in Research Data Management (RDM)
| **Presentation** | Literature Review and Wider Concepts
By **Maryam Bugaje** (maryam.bugaje@northumbria.ac.uk)

Abstract: The question of how data produced from research activities may be efficiently and profitably managed to derive the most value from it and realize all its potential benefits has become an important question in the boards of universities, funding bodies, governments, and other institutions of learning & research. This great interest in Research Data Management (RDM) has made it a most lively and changeable field. It will be the aim of this presentation to give a general overview of RDM as it stands today: the challenges in its way, it's likely future, innovative solutions developed or currently being developed, and indications in the current marketplace. For this reason, the author will draw upon ideas and findings in the literature as well as recent surveys conducted UK-wide and Northumbria-wide on the subject. The presentation is intended to be broad and general rather than narrowed-down and confined.

Your First & Second Year Research Plans vs. Reality: What Really Happens to Your Research Programme Over Time?
| **Presentation** | Expectations and Reflections on Research
By **Dmitry Dereshev** (dmitry.dereshev@northumbria.ac.uk)

Abstract: A well-planned research programme allows the planner to foresee many potential pitfalls and time-drainers and avoid those successfully. Planning, prioritizing, and balancing multiple objectives also allows for a more comprehensive and fulfilling PhD to take place. All of this sounds good on paper (much documentation of which we, as PhD students, must produce), however many students only create those plans to satisfy various stages of PhD programme (proposals, annual progressions), only to forget about them completely, and follow some other ways to completion. In this short presentation I will reflect on how plans change over time, what successfully passed as plans at various stages of the PhD programme, and how naïve those plans can look once you start reviewing them. The presentation will focus much less on what's written in the policies, and much more on how research happens, and how research programme compares to that.

The Information Behaviour of Aspiring Undergraduates on Twitter: Key Findings and Lessons Learned
| **Presentation** | Discussion and Conclusions
By **Lara Dodd** (laura.dodd@northumbria.ac.uk)

Abstract: A PhD study by Lara Dodd (supervised by Prof. Gobinda Chowdhury and Dr. Morgan Harvey) sought to investigate how aspiring undergraduates were using digital resources to make decisions regarding Higher Education. This research adopted a novel methodology and captured 494,180 tweets that represented a 16-month long journey that aspiring undergraduates take, from initial decision-making processes and applications through to the end of their first semester at University. The research has been successful in achieving a wider understanding of the aspiring undergraduate context and journey and in considering how the information needs of aspiring undergraduates are, or aren't, being met. Findings expand on existing knowledge and uncover some new behavioural characteristics in this context. Whilst the research outlines limitations in the knowledge, skills and capabilities of aspiring undergraduates and hurdles (e.g. for certain demographics), it also identifies successes and some exemplary practices (i.e. UCAS). This research updates and reframes how aspiring undergraduates are understood, and sheds light on how they think and understand the world. University is a significant personal and financial investment for students and this intelligence can be used by those supporting aspiring undergraduates to increase the efficiency of support, which could, for example, potentially help reduce the number of students ending up in wrong courses or universities or even prematurely 'dropping out' of university.

A Deep Metric Learning Approach to Unifying Mesh Saliency and Non-Rigid Shape Matching
| **Poster** | Research Methodology
By **Shanfeng Hu** (shanfeng.hu@northumbria.ac.uk)

Abstract: Saliency detection and shape matching are two fundamental shape analysis tasks: the former identifies semantically important points on a mesh, and the latter finds semantically meaningful point correspondences across meshes. Previous research addresses them separately, ignoring their connection that can be used to better handle non-rigid deformations. We make the first attempt to solve them together, allowing correspondence to improve the deformation-invariance of saliency while using saliency to enhance the semantic feature localization of matching. We infer saliency and matching jointly from a metric and parameterize it using a deep recurrent neural network (RNN) with soft-thresholding and max-pooling. We also formulate a unified loss function to learn the two tasks together. Results show that our approach outperforms existing saliency detection methods in one-shot, few-shot, and standard training scenarios, while improving model-based and learning-based methods to match non-isometric shapes.

Cost Effective Pricing Model for Long-range Autonomous Valet Parking (L-AVP)
| **Presentation** | Literature Review and Wider Concepts
By **Muhammad Khalid** (m.khalid@northumbria.ac.uk)

Abstract: Continuous and effective developments in autonomous vehicles are happening very fast. Industries nowadays, are interested in introducing less costly and highly controllable autonomous vehicles, to public. As a result, autonomous vehicles are rapidly increasing on roads. Due to increase in number of vehicles, there is a high need of car parks in public locations. Car parks are used to accommodate increasing numbers of autonomous and non- autonomous vehicles. Car parks are usually deployed outside city centre, to avoid traffic congestions and ensure road safety in public places. Normally drivers leave their vehicles at drop-off spots and collect their vehicles from pick-off spots on return.

Traffic congestion can be alleviated by lowering down the parking prices.

This paper has proposed a cost-effective parking cost estimation model for Long-range Autonomous Valet Parking, called CE-Park. The proposed model has categorized car parks into multiple categories with respect to price and user preferences. The aim of proposed model is to select a car park with minimum effort and least cost.

Stock Price Manipulation Detection Using Data Mining Techniques
| **Presentation** |Expectations and Reflections on Research
By **Baqar Rizvi** (baqar.rizvi@northumbria.ac.uk)

Abstract: Stock market manipulation means illegitimate or illegal activities trying to influence the prices of stocks, hence diluting the legal definition of trading stocks. In this research, a model for detecting Stock price manipulation is presented for manipulation schemes treated as anomalies like Pump & Dump, Quote stuffing, Gouging or Spoof Trading etc. Although such schemes keep on evolving but these primitive ones have haunted the market for a long time and ruined investors faith in a security as well as the market causing economic losses in $millions. The model is presented on level 1-tick data which contains highly volatile time series and a high trading frequency making the detection more challenging. In literature, a small number of studies based on unsupervised learning for Stock market manipulation have been carried out. In addition, the existing studies focused only on specific anomalies and were not generalized enough to capture other anomalies. The research model used in this work uses unsupervised learning where the input data is decomposed using Empirical Mode Decomposition followed by Kernel Density Estimation based clustering technique for anomaly detection. The results in this work are also compared with existing benchmark approaches like K-means, Principal Component Analysis (PCA) based anomaly detection and Dirichlet process Gaussian Mixture Model (DPGMM) based anomaly detection and a maximum improvement of 84% in terms of detection accuracy is obtained.

On the Principles of Trauma Informed Care
| **Presentation** | Literature Review and Wider Concepts
By **Steven Thirkle** (steven.thirkle@northumbria.ac.uk)

Abstract: Trauma Informed Care (TIC) is an approach that can be defined as "a system development model that is grounded in and directed by a complete understanding of how trauma exposure affects service user's neurological, biological, psychological and social development" (Paterson, 2014). Organisational principles have been developed to guide the transformation of services and settings in becoming trauma-informed. Mental health systems should operate in accordance with TIA principles if they wish to be trauma-informed. In literature, there are many adaptations on the principles of TIC, although they all share a strong congruence. However, it is argued that most of the current understanding of TIC rests on principles and values rather than specific recommendations for action (Yatchmenoff et al., 2017).

Jennings (2004) initially developed seven principles that services need to emphasise. Elliott et al. (2005) refined these initial seven principles to develop 10 principles of trauma-informed care that services needed to employ. These principles have been further refined and are continuously being shaped to reflect individual organisation's needs. On comparing the literature on TIC, facilitating TIC into services is often withheld at the implementation phase, held back by the strong emphasis on principles and guidelines. Although, there is a wide range of principles contributed to the literature. They are all congruent and all fall under the domains of safety, power, and self-worth.

Data Analytics in Healthcare System
| **Poster** | Research Methodology
By **Masooma Masooma** (masooma.masooma@northumbria.ac.uk)

Abstract: General practice is a primary health care provider in the UK where General Practitioners (GPs) work in collaboration with other clinical staff such as nurse practitioners (NP), health care assistants (HCA), psychiatrist and other related staff to manage and treat community health (General 2017). Primary care is critical to the effectiveness and sustainability of the health system in the UK. In the last five years there is a consistent gradual degradation in the quality of service delivered by General Practices (Association 2016) (Baird, Charles et al. 2016). There are many factors which played a key role in the crisis of general practices e.g. ageing population, chronical and complex illnesses. Furthermore, the shortage in recruitment and retainment of clinical staff resulted in excessive GP workload (Baird, Charles et al. 2016). According to a report published by British Medical Association's committee, the main reason for decline in quality is a huge rise in GP workload (Association 2018) (General 2017). General practices are no longer able to extend the standard appointment time to manage patients with complex needs. To address the extreme rise in GP workload this research aims to provide an innovative economical workforce model to complement the design of healthcare information system to successfully incorporate data analytics for evidence-based decision making. To accomplish this, we proposed an optimize data analytics machine learning algorithm to shift workload from GP to other clinical staff e.g. nurse practitioner, paramedics, health care assistant and other clinicians using competency framework.

In-Vitro Blood Cell Detection via Deep Learning for Microfluidic Point-of-Care Diagnostics
| **Poster** | Literature Review and Wider Concepts
By **Tiancheng Xia** (tiancheng.xia@northumbria.ac.uk)

Abstract: Automated in-vitro cell detection has been a key theme for artificial intelligent biological analysis such as biopsy, drug analysis and decease diagnosis. Along with the rapid development of microfluidics and lab-on-chip technology, in-vitro live cell analysis has become a critical task for both industry and research communities. However, it is a great challenge to obtain the precision information of live cells from numerous microscopic images. In this paper, we investigated in-vitro white blood cell detections and applied a novel deep learning technique, namely Faster R region-based convolutional neural networks, for the microscopic blood cell detection. Our experimental results demonstrated that fast blood cell analysis via automated microscopic imaging can achieve a high accuracy of ~99%, revealing its effectiveness for intelligent microfluidic blood diagnostics.

Geography

Greener, Wetter, Browner: Consequences of Arctic Climate Warming and Land-Cover Change for the Biogeochemistry of Dissolved Organic Matter in Freshwaters
| **Presentation** | Discussion and Conclusions
By **Samuel Cottingham** (samuel.cottingham@northumbria.ac.uk)

Abstract: In arctic regions mean annual air temperatures have risen at a rate twice the global average over the past century. Warmer conditions are promoting the 'greening' of tundra environments by shrubs and trees, but also thawing permanently frozen soils underneath peatlands causing 'wetter' soil conditions. Both greening and wetting responses to warming have been linked to the loss of organic carbon (OC) previously stored within soils which may further enhance climate warming by bringing old OC back into the modern-day carbon cycle.

Published estimates of the amount of OC entering freshwater environments in arctic regions are continually rising with field data supporting a widespread 'browning' phenomena. Browning represents changes in the chemical soup of OC which is present as dissolved organic matter (DOM) in small headwater streams. Changes in DOM sources towards those with more soil-derived chemical characteristics (e.g. low nutrient, high carbon) may promote the outgassing of greenhouse gasses from freshwaters by bacteria. Browning can also reduce light penetration into water reducing primary production which increases the reliance on DOM as an energy and nutrient resource for ecosystem function.

This presentation describes the main insights from my research about the possible consequences of greening, wetting and browning on the concentration and composition of DOM and microbial resource usage in northern Sweden, a region which is actively responding to rapid climate warming.

The Climate Time Bomb: Are the UK's Millennials Listening?
| **Presentation** | Discussion and Conclusions
By **Mark Ashley Parry** (ashley.parry@northumbria.ac.uk)

Abstract: Climate Change is a widely recognised issue amongst both academia and civil society and can be defined as the significant large variation in the state of climate, which can occur over an extended period of a couple of decades or longer. Currently, research shows that although most young people believe that climate change is happening, the amount of active engagement with environmental organisation and climate change in general is low. This is surprising, as the current generation of young people are the first generation to have been brought up with climate change being an accepted and fundamental issue in civil society. This has led to some academics within the United States to describe it as the "climate spiral of silence". This is concerning as several world leaders and scientists believe that they are also the last generation to make a difference in stopping the worst effects of climate change from occurring.

My research is focused on the three different ways in which the Millennials could respond toward climate change. The different ways are: perception, engagement and reaction. The results of this ongoing research demonstrate that there is a generational divide in both perception and engagement of climate change. The presentation looks at these differences and examines why these differences are occurring.

Environmental Influences on Ancient Maya Land-Use in Belize
| **Poster** | Literature Review and Wider Concepts

By **Adam Bermingham (**adam.bermingham@northumbria.ac.uk)

Abstract: The Classic Maya civilisation (250-1000 AD) of Mesoamerica is known to have caused large-scale environmental impacts against a backdrop of climate instability. Existing palaeoecological research highlights large declines in forest pollen that are attributed to past deforestation and maize agriculture. Many of these studies focus around large ceremonial centres, which may reflect the intensive agriculture that was required to support high population densities. Palaeoecological investigations from medium to low-density sites provides an opportunity to investigate how the Ancient Maya managed their landscapes using alternative strategies.

Site selection was based on three criteria: (1) a diverse range of ecosystems is represented; (2) all sites are not located near large ceremonial centres; (3) all sites were continuously occupied during the Ancient Maya period. Island (coastal) and mainland sites were compared to investigate ancient Maya land-use strategies in these different environments. Peat cores were extracted from Marco Gonzalez (189cm) and Basil Jones (350cm), located within mangrove and dry forest ecosystems, respectively, on the island of Ambergris Caye. On the mainland, a short lake sediment core was extracted from Laguna Aguacate (Spanish Lookout). High-resolution pollen and charcoal analyses will determine past land-use strategies, such as forest clearance, permaculture and swidden agriculture. Key pollen indicators of landscape modification, such as crops (*Zea mays*) and economically important taxa (e.g. palm) will show the land-use strategies of the Ancient Maya; while changes in the abundance of forest pollen will determine the extent to which deforestation occurred around medium-density sites.

Mechanical & Construction Engineering

Identification of Infrastructure Project Uncertainties During Project Initiation Stage Using System Thinking
| **Presentation** | Literature Review and Wider Concepts

By **Onalaja Afolabi** (afolabi.onalaja@northumbria.ac.uk)

Abstract: Traditionally, construction project professionals tend to focus more on risk and its impact neglecting the effective management of uncertainties. A lot of risks emerges from uncertainties which were not properly identified at the early stage of the project. Utilization of non-systemic (Traditional) approaches in risk management is widely practiced by construction project professionals which is a deterministic technique based on experience and laid down format. Due to the complexity and dynamic nature of infrastructure projects a holistic approach which integrates system thinking by gaining understanding of the functions, relations between them and environmental influences is needed for effective uncertainty management. System thinking approaches sees a construction project as a whole system by understanding and examining the relationship, interactions between the parts (stages and processes) that comprise the entirety.

This paper describes a system thinking conceptual framework which is used in identifying uncertainties in infrastructure project initiation stage deduced from literature review. It forms part of an ongoing PhD research project whose aim is to improve costing in infrastructure project to accommodate uncertainties. The paper will conclude that system thinking approaches will enable key stakeholders in infrastructure project to identify and manage uncertainties that will impact on project goals adversely.

Arctic Permafrost Coastal Erosion: A New Conceptual Model for Retrogressive Thaw Slump
| **Presentation** | Research Methodology

By **Samuel Hayes** (samuel.hayes@northumbria.ac.uk)

Abstract: Arctic permafrost coasts account for 34% of the global coastline and are some of the most rapidly changing landscapes on the planet. Sea ice loss, ocean warming, storms, increased rainfall and more are contributing their destabilisation, with some experts describing them as being in a state of collapse. This is having a wide range of impacts, from the forced relocation of coastal communities to increased ocean acidification and other alterations to the nearshore biogeochemical cycles.

Among the most striking and active forms of permafrost erosion are retrogressive thaw slumps (RTS). These features are a form mudslide, where thawed sediment flows along the surface of embedded massive ice bodies within the permafrost. This can result in rapid mass wasting events with large volumes of sediment and organic carbon entering the nearshore. However, the activation, progression and subsequent quiescence of RTSs is still poorly understood. As part of this research a new conceptual model for RTSs is being created, based on research from an RTS complex at Peninsula Point, in the Western Canadian Arctic. Among other techniques, drone and LiDAR based digital elevation models have been used to assess the erosional processes and different stages within the life of an RTS. It is hoped that the new insights gained from this research will lead to an improved understanding of RTS processes and more accurate estimates of carbon and mass loss compared to current satellite-based observations.

The Water Supply in Ancient Roman Towns: Hydraulic Engineering in Pompeii
| **Presentation** | Discussion and Conclusions
By **Maria Monteleone** (maria.monteleone@northumbria.ac.uk)

Abstract: The water supply in ancient Roman towns has been investigated through the study of many archaeological remains; in the last ten years various studies have attempted to recreate the connections between the structures and to understand the operation of the entire water system, however archaeologists are not able to consider in detail the quantitative aspects of hydraulic engineering. Through Pompeii case study the analysis of a complete public water supply system of the Augustan age is being completed in a three years project aiming to investigate the engineering design principles and their adaptation to the different needs of operation in about 90 years' time span. An estimation of flowrates for public fountains and some private houses has been produced on the base of data collected in a three stages survey on the site and general hydraulic calculations adapted to the features of ancient Roman pipes. The project is in the second year of development and is expecting to produce a quantitative analysis of the entire water network within the next 6 months. Ancient gravity-powered water networks used various optimized techniques for the water distribution and the general interest of modern engineers is to verify their efficiency and their possible adaptation to modern times water networks design and management.

Additive Manufacturing Fabricated Bio-Inspired Structure and Device for Advanced Engineering
| **Presentation** | Expectations and Reflections on Research
By **Ansu Sun** (ansu.sun@northumbria.ac.uk)

Abstract: Intraocular lens is a lens implanted in the eye used to treat cataracts or myopia, also known as IOL. Since IOL invented in 1940s, it has cured millions of people around the world following cataract surgery. Modern advancement has introduced phacoemulsification to remove the cataract through a small incision (millimetres). This minimally invasive surgery requires a flexible IOL that could be folded and deployed. The main categories for foldable IOL materials are silicone (hydrophobic), hydrophobic acrylic and hydrophilic acrylic (hydrogel). Due to optical distortions, flexibility, biocompatibility, complications etc., we chose PNIPAM copolymer gel. It is a multi-responsive gel with superior elasticity. IOL become white as cataract when we simulate the IOL put in the human eye environment. That is calcium deposition, we modify the formula of hydrogel we are using, and hope to solve this issue.

There are various IOL structures depending on the practical needs, single piece and multi-pieces with structural haptics. We chose three diopters during moulds design for people with prescription as well. All these IOLs manufactured by 3D printed moulds.

Metal-Elastomer Surface Deformation Control on Super-Compressible Strain Transducer Arrays
| **Presentation** | Expectations and Reflections on Research
By **Cong Wang** (cong.wang@northumbria.ac.uk)

Abstract: In this project, we report the metal-elastomer surface deformation control strategy of a strain transducer array capable of measuring compressive strains up to 60%. Pairs of multi-finger electrodes separated by different inter-digit gap distances are forced into contact by induced surface creasing deformation at different strains. Designed structures have been developed to explore and optimize the electrode-elastomer hybrid surface deformation. The deformation is due to large compressive strains in the "x-direction" but stretching caused by the Poisson effect can also take place in the "y-direction". This initial study has been focused on the relationship between electrode geometries and compression strain ratios, with the growth and co-existence of wrinkles and creases on multi-switching electrodes being characterised for the first time. Future work will focus on fully characterising the mechano-responsive electrical switching mechanism of the designed sensors.

Biaxially Shaping Droplet by Initiating Localized Pattern Bifurcation upon Engineered Elastic Surface
| **Presentation** | Expectations and Reflections on Research
By **Ding Wang** (ding.wang@northumbria.ac.uk)

Abstract: Wetting phenomena with the ability to reshape liquids within a capillary length have many technological applications including coating, adhesion, self-cleaning surfaces, printing and nano-microfluidics. Sinusoidal wrinkle and crease patterns on an elastic substrate can create an ordered roughness with the potential to control droplet motion. Non-uniform distributions of surface energy can cause anisotropic wetting and droplet deformation, while asymmetric chemical or physical patterns on a material surface can cause directional wettability. On a micro-wrinkled surface, the geometrical aspect ratio strongly influences the shape of a droplet. On an elastic wrinkled groove surface, as certain compressive strain is approached, a droplet can start imbibing into the grooves leading to an eventual filling of entire grooves. To achieve highly controllable instabilities and a bi-axial switching droplet shape, we created a patterned elastic surface able to initialize localized surface instabilities and induce reversible surface morphology changes. At equilibrium, our topographic surface consists of a set of circular voids distribute din an equilibrium manner. By using plasma treatment and mechanical stimuli, we investigated the evolution of the nano/micro-structure on surface, which form under mechanical stimuli and redistribute the surface energy. A droplet placed on our surface is pinned by the topographic features and deforms as the circular shapes elongate to elliptical shapes. The static, advancing and receding contact angles were measured before and after plasma treatment, showing the enhancement of the surface wettability due to changes in the surface chemistry, morphology and roughness. This finding opens a window to create the robust wetting state surface with potential applications in microfluidics, bio-engineering and soft robots.

Using a Conceptual Framework to Develop Research Methodology
| **Presentation** | Research Methodology
By **Nicola Young** (nicola.j.young@northumbria.ac.uk)

Abstract: At this stage of my project, the research title continues to be: 'A conceptual framework to support the governance of digital projects in the public sector'.

Alongside investigating the literature already available on the background and context to public sector project governance, it is necessary to understand what a 'conceptual framework' could look like and whether such an outcome continues to make sense as my research develops.

I find research methodology to be a challenging area, and so I have used the need to grasp the principles and application of conceptual frameworks to help develop the outline of my methods chapter, with a view to submitting as a potential journal article.

The presentation will provide an overview of how I have applied the approaches suggested in Miles and Huberman's (1994) 'Qualitative Data Analysis' book to develop an emerging conceptual framework for my research methodology.

The conceptual framework diagram provides the story and sequence of the planned overall approach to my research. It shows how it will move from an initial literature review to the completion and analysis of a qualitative survey; how combining this with the examination of secondary data will inform the identification and execution of multiple case studies. Ultimately, it will lead to a refresh of the literature review against the findings, culminating with a final analysis and presentation of research outcomes.

Organizational Cultures and Stakeholder Success Criteria on Construction Project
| **Poster** | Literature Review and Wider Concepts

By **Ahmed Alhiddi** (ahmed.alhiddi@northumbria.ac.uk)

Abstract: This research presents the findings of a theoretical investigation into the association between organizational culture and stakeholder management. With an aspect focused on international construction projects, the study explores the relationship between the cultural origin of key stakeholders and the cultural context in which projects are realized. Emphasis is placed on the examination of project outcomes and the factors that influence cultural domain. Secondary data suggests stakeholder management and corporate culture are critical areas that decide an organization's success. The importance of these areas will inevitably grow in the future as projects continue to be procured in a global economy. Identifiable theoretical associations between the constructs have been found that provide early evidence that stakeholders and culture influence project life-cycles. Stakeholders—organizations and their representatives—must be informed of the distinct types of cultures and success criteria to ensure they manage them efficiently alongside traditional and long-accepted project variables.

An Investigation into The Use Blockchain Applications for the Construction Industry
| **Poster** | Literature Review and Wider Concepts

By **Jennifer Li** (jennifer.li@northumbria.ac.uk)

Abstract: Distributed ledger technologies (DLTs) including blockchain are increasingly being investigated as a potential solution to address many of the challenges preventing the construction industry's technological advancement such as collaboration, information sharing and intellectual property rights. Existing studies addressing blockchain applications within construction and the built environment have ignored the interrelatedness of social and technological dimensions. To address this gap, this paper proposes a multi-dimensional emergent framework for DLT adoption within the construction sector.

A systematic literature review (SLR) of 53 papers found seven categories of applications within the built environment: smart energy, smart government, smart homes, smart cities & the sharing economy, intelligent transport, Building Information Modelling (BIM) and construction management; and business models and organisational structures. An extensive list of challenges and opportunities facing implementation of this technology in the construction industry was identified.

Following the SRL and a focus group discussion, a framework was developed taking a socio-technical systems approach that encompasses three dimensions: political, social and technical. The framework was overlaid with the construction-related challenges and opportunities and identified several associated agents across the dimensions. The structured and inter-connected dimensions provided by the framework can be used by field researchers as a point of departure to investigate a range of research questions from political, social or technical perspectives.

Wetting Smart Surfaces with Switchable Wettability
| **Poster** | Expectations and Reflections on Research
By **Zhenghong Li** (zhenghong.li@northumbria.ac.uk)

Abstract: In this project, we report the wetting smart surfaces with switchable wettability, using a 3D-printed sample. There are four parallel grooves in the sample's surface, with ridge width "w1" being 0.2mm, 0.5mm, 0.8mm; the grooves width "w2" being 1mm; and the grooves' height "h" being 0.5mm.

The point is to test the sample's contact-angle by synthesising the hydrogel and injecting it into the grooves. This Chemically improves the responsive properties for materials. By immersing the surface in different concentration PBS solutions, hydrogel swells and collapses. My project develops and optimizes the actuation effects for responsive materials-based structures/devices. Changing the grooves' width or space allows to precisely control the hydrogel's swelling or collapse orientation. The initial work is to ensure the mesoscopic scale sample, and test the contact-angle, the hydrogel synthesis, and the chemical modification from hydrophilic to hydrophobic. Future work will focus on the developing and optimization of the actuation effects for responsive materials-based structures/devices.

Snapping and Deploy on the Curved Surface Induced by Swelling of Hydrogel
| **Poster** | Expectations and Reflections on Research
By **Yingshi Liu** (yingzhi2.liu@northumbria.ac.uk)

Abstract: Surface elastic instabilities, such as buckling, creasing and folding, could be generated on the hydrogel structures where the multi-layered surface results from a large gradient of osmotic pressure formed within the hydrogel during the swelling process. The experiments and mechanisms of surface instabilities developed on flat surface have been studied extensively in the past, while the investigation on curved surface has rarely been reported. Here, the Polyacrylamide hemispherical shell and semi-cylinder shell fabricated by 3D printed mold are used to study the snapping which induced by swelling of hydrogel. Measurement of the surface morphology (wavelength, amplitude of creasing) is carried out by the laser scanning confocal microscope (LSCM). A series of experiments are conducted to investigate the effects of the swelling ratio and the thickness of shell on the speed of snap and deployed process. The experiments reveal that the creasing on the curved surface and circumferential buckling occurred when the hydrogel is immersed in DI water. As time goes on, hemispherical shell and semi-cylinder shell snap, then automatically deploy and recovery to hemispherical or semi-cylinder shape. The theoretical and numerical analysis are performed to predict the snapping and unfold upon swelling.

Group Dynamics in Organisational Decision-Making: An Ethnography of Construction Design Management
| **Poster** | Literature Review and Wider Concepts
By **Hazel Ponton** (hazel.ponton@northumbria.ac.uk)

Abstract: The design process for construction projects is widely recognised as being difficult to manage. This complication is due to the iterative nature of design development and the fragmented nature of the stakeholders involved in the building design management and construction processes, which include designers, constructors, clients, and end-users. Understanding how stakeholders socially interact and behave during the building design management process merits investigation. Group dynamics have long been acknowledged as critical factors affecting a team's social and task-related success and, as one would expect, influence the effectiveness of the building design management process and project outcomes. As design team meetings are key to the building design process, this study aims to understand how key stakeholders involved in the building design management process interact with one another during design team meetings, and how these social interactions and inter-personal behaviours affect group decision-making. An ethnographic approach will be adopted to harvest qualitative data arising from the non-participatory observation of building design team meetings. The social interactions and behaviours of team members will be captured using a 360° panoramic video-recording camera in addition to the observationally-based reflective comments of the researcher. The main objective of the longitudinal data collection phase will be to record the social interactions of 30 consecutive building design team meetings for three live case study buildings of a similar type. A representative sample of significant building design management problems, i.e., critical events, will be explored during a deep-dive analysis using computer-assisted qualitative data analysis software. The naturalistically-centred recommendations arising from the qualitative data that will be collected, analysed and interpreted will help to bridge the current knowledge gap that exists in the extant literature and provide opportunities for improvements to the building design management process.

CuO/Graphene Nano-Flower Catalyst for CO2 Electro-Chemical Reaction
| **Poster** | Discussion and Conclusions
By **Yucheng Wang** (yucheng.wang@northumbria.ac.uk)

Abstract: Electrochemical reduction of CO_2 to low carbon organic compounds has been considered as a promising method to mitigate the greenhouse effect and produce useful energy carrying chemicals. However, the development of catalyst with high activity, selectivity, and good stability is still the bottleneck to accomplish this goal. Cu based catalysts have been reported to meet such requirement. In this work, we prepared CuO nano needle and CuO/graphene nano-flower catalysts using polyol method. The catalyst was examined using XRD, SEM/EDS and electrochemical testing methods etc. Results indicate that CuO/graphene nano-flower exhibits a high catalytic activity for CO_2 conversion to formate with a Faradic efficiency of 60% (Nano needle) and 75% (Nano flower) under -1.1V vs. SHE. We also will demonstrate membrane electrolyte assembly-based device for CO_2 electrochemical reduction. In where, the CuO/graphene nano-flower catalyst is coated on gas diffusion layer as the cathode.

Graphene aerogel is utilized in our project as the next generation electrode. We have synthesized graphene aerogel using Agar geltine method, and finished the properties testing including contact angle test, conductivity test and SEM test.
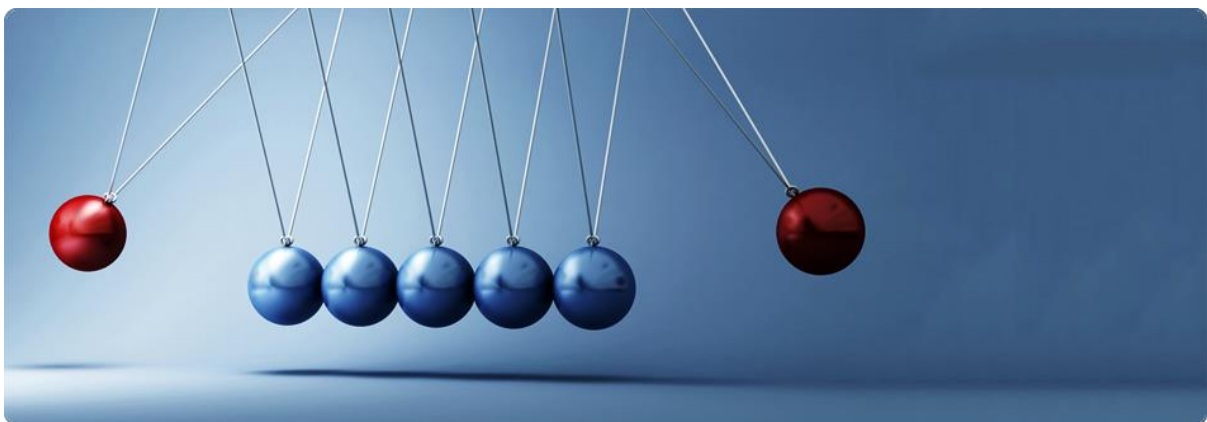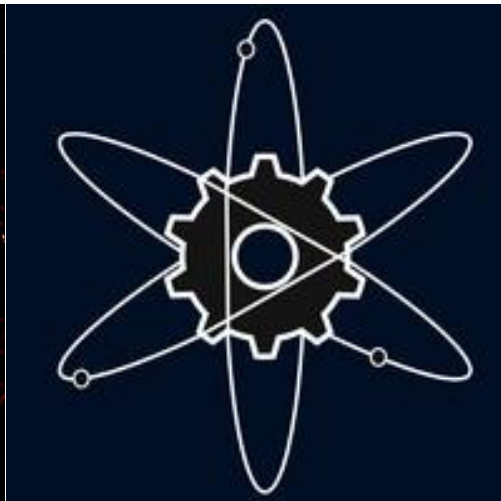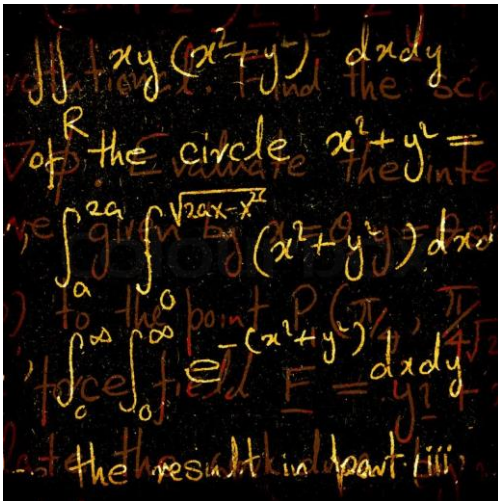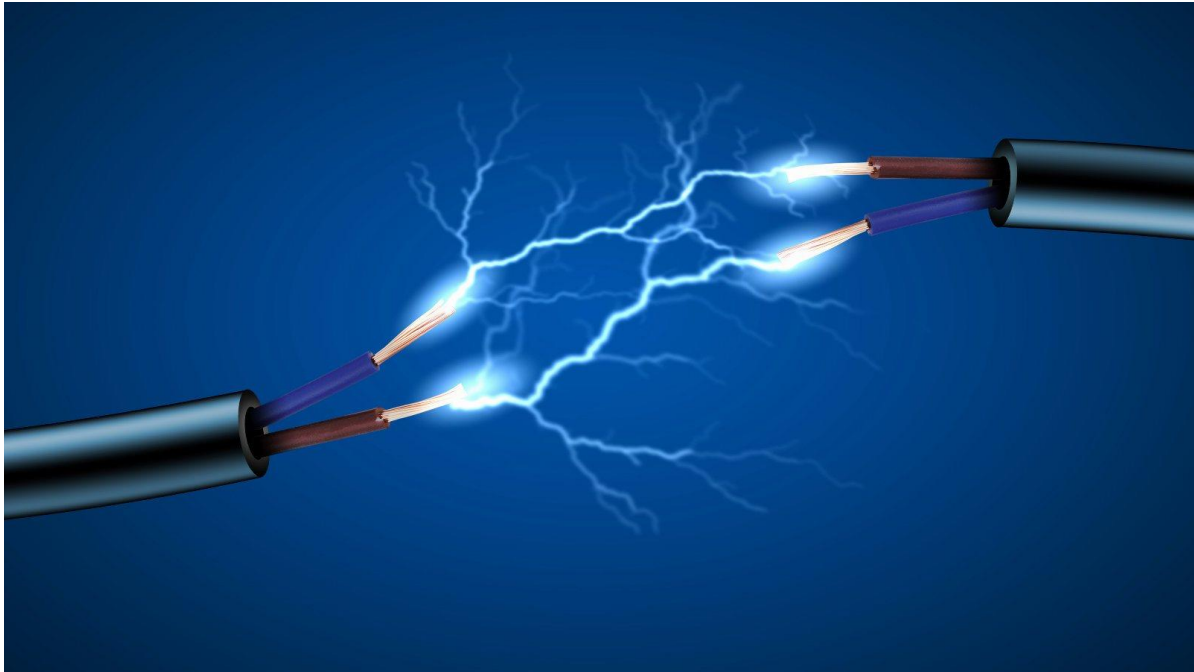
Mathematics, Physics & Electrical Engineering

Antimony Selenide Thin Film Solar Cell Fabrication by Thermal Evaporation
| **Presentation** | Research Methodology
By **Nik Ahmad** (ahmad.nik@northumbria.ac.uk)

Abstract: High efficiency in current Silicon solar cell is disadvantaged by high material requirement and fabrication cost. While the second-generation thin film material seems a promising alternative candidate for Silicon, the material toxicity and availability remain the main concern. Antimony selenide (Sb_2Se_3) is one of the emerging material to be used as the absorber material in thin film solar cells. Low cost, non-toxic, earth abundant, high optical absorption coefficient as well as suitable energy band gap are amongst key attributes that makes Sb_2Se_3 a viable absorber candidate to be investigated. In this study, Sb_2Se_3 thin films were thermally evaporated onto glass substrates at various substrate temperatures to study their physical and optical properties. A preliminary device with superstrate configuration ($Glass/FTO/CdS/Sb_2Se_3/Au$) was subsequently fabricated to analyse the performance of the Sb_2Se_3 based device. The current-voltage characterisation led to the solar cell achieving a conversion efficiency of 0.22 % with other parameters such as open circuit voltage (V_{oc}), current density (J_{sc}) and Fill factor (FF) being 175 mV, 3.35 mA/cm2 and 37.73 % respectively. The low value in current density is an indication that high carrier recombination rate is taking place at surfaces/interfaces. In addition, an unwanted buried junction behaviour of these Sb_2Se_3 based devices is suspected to present according to the External Quantum Efficiency (EQE) profile.

A Study of Vehicle for Energy Services at a Household Level
| **Presentation** | Research Methodology
By **Ridoy Das** (ridoy.das@northumbria.ac.uk)

Abstract: In recent years, electric vehicles (EVs) have gained considerable popularity as an effective way to reduce the environmental footprint of the transportation system. However, high EV penetration and uncontrolled charging can pose significant challenges to local distribution networks. Alongside, renewable energy sources (RES) are increasingly connected to the electricity grid, due to their environmental benefits and low operational cost. On the other hand, when RESs are massively deployed, their intermittency can cause significant problems to the power grid. In this context, the concept of Vehicle for Energy Services (V4ES) is proposed as a solution to these challenges, by exploring the synergies between RES and EVs characteristics and efficiently integrating them in the electricity system. In V4ES, EV charging is smartly controlled to serve as a buffer for intermittent RES and storage to supply the local electricity load. In this way energy autonomy is maximized and the energy cost of the household is minimized. By providing storage, EV batteries incur extra cycling which leads to degradation, therefore, the parameters that affect this aspect need to be considered. This project investigates a method to optimize the operational cost of a household energy use. The proposed technique is applied to a pilot of the SEEV4-City project, which includes a photovoltaic (PV) system, an EV and an energy storage system (ESS). The important dimensions of energy autonomy, battery degradation, grid impact and the energy cost of the household are optimized. This method is scalable and can be employed, along with predictions, in quasi-real-time energy management systems.

Modelling and Fault Analysis of Doubly Fed Induction Machines for Offshore Wind Turbine Systems
| **Presentation** | Research Methodology
By **Yichuan Fu** (yichuan.fu@northumbria.ac.uk)

Abstract: Doubly Fed Induction Machine model for offshore wind turbine systems have been built with use of MagNet software. Meanwhile, the physical characteristics and behaviours of the DFIM have also been analysed based on Finite Element Method (FEM). The value of stator slot wedge width ratio was defined as a reference criterion due to achieve the maximum torque and minimum torque ripple. For the relation between electro-magnetic and mechanical angle, different four rotor/stator slot topologies have been designed and analysed in comparisons between the case study and conventional DFIMs. The magnetic flux distributions have been analysed by different four value of rotational speed, which is the synchronous, rated, sub-synchronous, and super-synchronous speed, respectively. An analytical field calculation model for the Doubly Fed Induction Machine (DFIM) has also been developed. The field calculation region is divided into twelve solution sub-domains, including rotor core back, rotor inner-layer slot/winding, boundary between rotor inner- and outer-layer slot/winding, rotor slot wedge, rotor slot opening, air-gap, stator slot opening, stator slot wedge, stator inner-layer slot/winding, boundary between stator inner- and outer-layer slot/winding, and stator outer-layer slot/winding, respectively.

New Ways to Generate Grain Growth in SnS Absorber Layers by Post-Deposition Heat Treatment
| **Presentation** | Discussion and Conclusions
By **Stephen Nwankwo** (stephen.nwankwo@northumbria.ac.uk)

Abstract: Tin Sulphide (SnS) is a promising yet under-explored absorber material for photovoltaic applications. SnS thin films unlike CdTe are non-toxic and in contrast to CIGS does not contain rare and expensive elements [1, 2] but the low efficiency of SnS solar cells which to date is limited to 4.4% is still a challenge [3]. A very high quality and stoichiometric SnS layers comprised of large grains are required to facilitate the transport of photo-generated carriers and reduce grain boundary recombination and thus enhance the power conversion efficiency of the solar cells.

In this study a simple and effective technique to considerably improve grain growth of thermally evaporated SnS thin films by post-deposition heat treatment is presented and discussed. SnS layers were first deposited onto SLG at optimized temperature of 350 °C by thermal evaporation and then annealed at temperature range of 400-500 °C in two different environments, N_2 and Se. For N_2 medium, layers were treated with $SnCl_2$ and $MgCl_2$ solution before annealing while, Se treatment were carried out in both in situ (vacuum) and ex situ (tube furnace). The effect of post-deposition heat treatment on the morphology, structural and optical properties of the layers has been studied. $SnCl_2$ has no considerable effect on grain growth while, $MgCl_2$ smooth the grain surface with no increase in grain sizes. The incorporation of Se in the annealing tube furnace is found to enhance grain growth and improve the Luminescence of the films, which is a critical requirement for fabricating efficient solar cells.

Low Hysteresis Surfaces to Control Droplet Shape and position During Evaporation on topological Surfaces
| **Presentation** | Research Methodology
By **Bethany Orme** (bethany.orme@northumbria.ac.uk)

Abstract: Evaporating droplets and accurate droplet control are both vital in applications such as heat and mass transfer, inkjet printing and microfluidics. Usually evaporation occurs as a random "stick-slip" motion or by holding a constant contact angle (CCA) at the surface. Stick-slip motion most commonly occurs on surfaces or coatings where macroscopic/microscopic roughness creates droplet pinning, prohibiting smooth droplet movement. Slippery Liquid Infused Porous Surfaces (SLIPS) provide the lowest hysteresis solution to droplet pinning. The ability to coat any surface, including topologically patterned surface, allows new insights into droplet dynamics during evaporation. Here we present CCA evaporation on topological surfaces, which yields droplet shape governed by the surface energy of the droplet free of pinning.

We produce surfaces that are characterised with three methods to ensure the surface shows the smallest contact angle hysteresis. By applying this SLIPS coating to the macro topography, during evaporation, the droplet undergoes a series of snap events by moving from an unstable surface position to a lower energy stable position. The droplets shape predictably and reproducibly alters therefore varying this underlying topography can change the sequence of droplet configurations exhibited, leading to droplet control.

Underwater Acoustic Communications
| **Presentation** | Discussion and Conclusions
By **Boddu Pranitha** (pranitha.boddu@northumbria.ac.uk)

Abstract: Research in Underwater Communications (UWC) is tremendously growing nowadays. Because of changes in undersea environment and multipath fading, it has become a challenging task for the researchers and scientists to communicate underwater. Various applications of UWC include Oceanography, Marine archaeology, and Rescue missions, under water sports, Military and Navigation purposes. Underwater channel is a time varying multipath channel causing Inter symbol interference (ISI), Inter Carrier Interference (ICI), Inter Channel Interference (IChI) and fading. Due to the detrimental effect of time and frequency spreading, achieving high data rates in underwater wireless communication is challenging. Orthogonal Frequency Division Multiplexing (OFDM) is a suitable modulation technique for UWC as it can solve ISI, IChI and multipath propagation. Coding at the transmitter in addition to OFDM using Hamming code improves the BER. It is also proved that LDPC code further improves the BER. To overcome the effect of multipath fading, diversity technique is used in UWC. Spatial diversity along with Maximal Ratio Combining (MRC) is found to be a better approach to improve the error performance. OFDM along with spatial diversity and MRC will mitigate the system against channel fading. Underwater Acoustic Communications (UWAC) using Multiple Input and Multiple Output (MIMO) structure is an emerging technology to enhance the data transmission throughput and allow multiple transmitters to simultaneously communicate in underwater environment. 4 QAM spatial modulation scheme is used thus minimizing the decoding complexity and overcoming the Inter Channel Interference (ICI). BER investigation is carried out over different link distances under acoustic Line of Sight (LOS). The utilization of Zero Forcing (ZF) equalizer, which estimates the transmitted data, proves a success of removing ISI.

High-Density Ratio Lattice Boltzmann Simulations of Immiscible Drop Collisions
| **Poster** | Research Methodology
By **Neeru Bala** (neeru.bala@northumbria.ac.uk)

Abstract: The physics and dynamics of a ternary fluid system are of special interests for a variety of practical applications, including combustion engines, ink-jet printing and oil recovery. Recent experiments demonstrated that if fuel and water are colliding in a combustion chamber, the water can be encapsulated by the fuel, causing micro-explosions that enhance the burning rate. In this contribution I will present a Free energy Lattice Boltzmann model combining multiphase and multicomponent terms, to handle two liquids and a gas phase with a density ratio of order 1000. The method is employed to investigate the complex fluid dynamics occurring during the impact between two immiscible drops. Preliminary results show that the method can capture the transition from adhesive to insertive collisions at varying of the relative surface tension, liquid viscosity, drop size and impact parameters, and to elucidate the encapsulation mechanism.

Exploring Visible Light Technology for Vehicle to Vehicle Communication
| **Poster** | Expectations and Reflections on Research
By **Elizabeth Eso** (elizabeth.eso@northumbria.ac.uk)

Abstract: Visible light communication (VLC) is an evolving technology and has been gaining a lot of attention over the past decade by researchers in both industry and academia. The development of high intensity light emitting diodes (LEDs) devices, which have about ten times the luminous efficiency of the tungsten incandescent lamp and is constantly increasing. Hence, it is becoming common practice to replace the incandescent and fluorescent lamps used in street lighting and vehicle headlamps with high power LED bulbs. This has generated great opportunities for the telecommunications industry, whereby the LED lighting can be used to create optical wireless communication links between vehicles. The number of vehicles on the roads is on the increase year by year; traffic congestion is becoming an increasingly widespread problem and road traffic crashes are the leading cause of death among young people as issued by the World Health Organisation. Therefore, intelligent transport systems (ITS) hold the potential to provide improved capabilities for enhancing traffic movement and safety on roads through the provision of information for safe driving and warnings to drivers. Therefore, this research aims to experimentally investigate V2V through VLC. A dedicated testbed will be developed to carryout experimental performance verification. The proposed designs of the Vehicular VLC network will be built upon multi-hop transmission enabling the connectivity between vehicles. This will involve the investigation of relaying protocols, and the use of high spectral efficient based signalling such as orthogonal frequency division multiplexing and multiple carrier-less amplitude and phase modulation.

Mapping the Uncertain Future of Longevity: NA Ensemble Approach for Forecasting Mortality
| **Poster** | Research Methodology

By **Mark Hancock** (mark.hancock@northumbria.ac.uk)

Abstract: In mortality forecasting the most popular model is seen as the Lee-Carter model. Whilst it performs well in some cases (and there are many extensions of this model), it is always used as a single model approach, which ignores the uncertainty regarding model choice. This project aims to develop an ensemble modelling approach that combines a suite of forecasting models to produce reliable point as well as uncertainty forecasts. Currently two models are being used, both in the Bayesian framework, that are shown to describe the observed data reliably, but each model shows different abilities in forecasting mortality in different age groups. At this stage of the project these two models are used to create a suitable weighting system for the combination of models. In doing so, the project also explores the options of calculating weights through an in-sample fit, as opposed to the conventional way of calculating weights from a cross validation period; the latter is unsuitable in situations when the observed data are limited. So far, our methods have included using the Deviance information criterion (DIC) and using a mixture model approach. Using data from the Human Mortality Database, these techniques are compared with that where the weights are obtained from cross-validation. Their forecast performance will be discussed in the poster.

The Fabrication of Extremely Thin Absorbers Solar Cells Based on Hydrothermally Grown ZnO Nanorods
| **Poster** | Discussion and Conclusions

By **Zahra Ishwein** (zahra.ishwein@northumbria.ac.uk)

Abstract: Solar energy is considered to be the most harvestable and abundant renewable energy source and as of late, huge advancement has been made in producing photovoltaics (PV) devices that can be mass deployed [1]. PV is rapidly evidencing to be one of the most powerful competitors for making renewables energy a typical energy source around the world [2]. By fabricating extremely thin absorber (ETA) solar cells, low cost fabrication and high efficiency can be achieved combining extremely thin solid-state absorber layer (100's nm) conformally deposited on nanostructured substrate [3]. The underlying ideas of ETA cell absorbers is that the nanostructure increases the optical path length of the absorbed photons and reduces the required lifetime of the charge carriers, therefore lowering the need for high quality absorber materials [4]. ZnO or TiO_2 micro/nano structures used as electron conducting layers are having a significant role in the fabrication of ETA solar cells [5]. Herein, a preliminary study on ETA cell fabrication, using solution-based growth (hydrothermal) method for the ZnO was conducted to grow nanorods (NRs) structure on an ITO-coated glass substrate. The fabricated ETA cell structure as the following: glass/ITO/ZnO seed/ZnO NRs/CdS/CZTS/P3HT/gold. The aim is for the CdS/CZTS to conformally coat the ZnO NRs, while P3HT acts as a hole transport layer which in turn helps avoiding shunting. The samples were studied for morphology using SEM, crystallinity using XRD, transmittance using UV-VIS-NIR spectroscopy and I–V of the completed solar cell by solar simulator.

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Life Cycle Assessment Study on Different Deposition Techniques for the Fabrication of Cu2ZnSnS4 (CZTS) Thin Film Photovoltaic Cells
| **Poster** | Research Methodology
By **Mehrnoush Mokhtarimehr** (mehrnoush.mokhtarimehr@northumbria.ac.uk)

Abstract: Cu2ZnSnS4 (CZTS) is one of the most promising alternatives for PV applications, since it is made from earth abundant and low toxicity materials. To assess the potential of CZTS PV cells in the future global market, it is useful to investigate the sustainability by assessing the possible environmental impacts of large-scale production. Life cycle assessment (LCA) of CZTS absorber layers fabricated by vacuum and non-vacuum deposition techniques has been studied using information from laboratory-scale processes as well as large scale estimations. Copper indium gallium diselenide (CIGS) was selected as a reference vacuum-based process. The paper compares the environmental impacts of the vacuum and non-vacuum processes by considering the three main damage categories of climate change, human health and eco-toxicity using Sima Pro Software. The results show that the CZTS films fabricated with both deposition techniques exhibit a significant potential benefit over the CIGS thin films. The toxicity to human health was found to depend critically on the compounds and components selected for preparing the precursors. The energy consumption for processing the CZTS thin films via the non-vacuum deposition technique is considerably less than that required for the other techniques.

Flexible SLIP Surfaces to Investigate Droplet Motion and Behaviour
| **Poster** | Expectations and Reflections on Research
By **Mumtahina Rahman** (mumtahina.rahman@northumbria.ac.uk)

Abstract: Nature has many examples of surfaces' wettability properties. Nepenthes pitcher plants, rose petals, lotus leaves, water striders, butterfly wings have inspired researchers to study the control of liquid droplets' interaction with surfaces.

Inspired by the surfaces' wettability properties of nature, researchers have studied the control of liquid droplets' interaction with surfaces. Well-designed nano- and micro-structured surfaces create the possibility of inducing and controlling new wetting scenarios such as super-liquid repellence, superhydrophobic and Slippery Liquid Infused Porous Surfaces (SLIPS). SLIPS are attractive because they offer low contact angle hysteresis and a lubricated surface on which it is easy to move droplets. The ability to shape, move and manipulate droplets on flexible SLIPS will allow new opportunities in several applications such as Lab on a chip, microfluidic devices and other cleaning processes. Being able to create SLIPS on flexible surfaces would further open the scope for research in SLIPS applications.

Here we present a simple method to create a SLIP surface on a flexible surface. Glaco nanoparticle spray coating is applied to flexible materials to make them superhydrophobic. Lubricating oil is applied to create slippery surface. Our surfaces have been characterised and show a sliding angle below 2°. The next phase of the research is to carry out tests on the capabilities of these SLIPS under stress and strain conditions.

Precision Time Synchronization and Coordinated Motion Control System
| **Poster** | Research Methodology
By **Jiwen Zhu** (jiwen.zhu@northumbria.ac.uk)

Abstract: This project describes a time synchronization-based motion control system, which provides a method for precisely controlling motion equipment in a wireless communication system and can be applied to fabric flow inspection. This system can be divided two parts: wireless coordinated motion control and simple image processing system. Wireless coordinated motion system is consist of two ARMsamr21 wireless boards, encoder, motor driver and stepper motor. One of wireless board and encoder are equipped on the loom as a master which mainly send time information and motion information of loom to another wireless board. Another board is equipped on motion system as slave board. This board mainly receives time information and control stepper motor reaching specified position at a specified time. The processing system is designed by Intel Atom J1900 industrial personal computer, industrial cameral and user interface. Atom J1900 IPC mainly process sampled images from industrial camera. The system solves traditional problem of leak detection of the product so that accuracy of detecting has been greatly improved. Besides the system uses a camera to test multiple looms, which can reduce the costs.

Evaluation Performance of Pulse-Coupled Oscillators
| **Presentation** | Research Methodology
By **Yan Zong** (yan.zong@northumbria.ac.uk)

Abstract: Time synchronization in wireless sensor networks, aiming to provide a common sense of timing among distributed sensor nodes, is a key enabling technology for many applications, such as collaborative condition monitoring, time-of-flight localization and underwater navigation and tactical surveillance. Due to the manufacturing tolerance and working condition variations, a novel state-space model for pulse-coupled non-identical oscillators is proposed to model a realistic clock oscillator with non-identical and time-varying frequency. Furthermore, a state feedback correction (i.e. the hybrid coupling mechanism) is proposed and implemented in the interacting mode of pulse-coupled oscillators to enable the system to move into steady state, thus achieving time synchronization in wireless sensor networks.

Experimental Demonstration of Angular Transmission of EEG signals using Visible Light Optical Camera Communication
| **Poster** | Discussion and Conclusions
By **Geetika Aggarwal** (geetika.aggarwal@northumbria.ac.uk)

Abstract: Brain Monitoring through electrical activity has substantial potential to recognize the brain functionality and abnormalities. Traditional EEG monitoring systems deploy several scalp electrodes, physically connected to the EEG recording machine however recently the wearable EEG devices have gained wide popularity due to lesser number of electrodes, ease and comfort. Some of the EEG machines employ wireless Radio Frequency communication protocols alike Bluetooth and ZigBee to transmit signal information wirelessly; however, both Bluetooth and ZigBee dependent EEG machines may affect the medical equipment and patient's health due to Electromagnetic interference. Hence, in view of shortcomings of RF communications in Healthcare, Visible Light communication (VLC) technology is the optimum solution since VLC uses the license free light spectrum (380 nm -780nm) and free from electromagnetic interference with enhanced security. The eruption in the usage of smart and advancement in technology extends the capacity of VLC implementation for the smart devices or camera with no hardware modifications. Furthermore, EEG recording from scalp electrodes is also done from electrodes situated at different angles and distances on the scalp for the comprehensive study of the brain. Hence this research work demonstrates the experimental wireless transmission of EEG signal using Visible light Optical Camera Communication deploying OLED screen as transmitter and camera as receiver, thus illustrating the BER performance at several angles at different distances. This proposed research application will be beneficial in hospital environment in comparison to traditional EEG systems owing to free from electromagnetic interference, low cost, low power and ease of comfort.

Optimizing SOCAL Surfaces
| **Poster** | Research Methodology
By **Steven Armstrong** (steven2.armstrong@northumbria.ac.uk)

Abstract: Surfaces that repel and shed liquids are desired in a large variety of industries. From repelling rain on the windshields of cars, to getting the last drop of ketchup out of a bottle [1]. There are many different treatments to improve the liquid shedding abilities of surfaces. Surface treatments range from chemically modifying a surface [2], changing the topography of the surface so liquids cannot penetrate [3] and imbibing a surface with a liquid that repels water [4].

This research investigates a new method of super hydrophobicity through grafting PDMS chains to a surface through an acid catalyzed reaction [5]. These chains act like a liquid layer that lubricates between the surface and droplet. The surface is characterized by measuring Contact Angle Hysteresis (CAH), (the difference between the receding and advancing angles a droplet makes with a surface). The lower the CAH the better the water repelling ability. By controlling the parameters in the manufacturing process of SOCAL surfaces, the CAH can be modified and optimized to reduce the CAH to less than 1°.

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